

THE IMPACT OF COSMETIC QUALITY STANDARDS ON FOOD LOSSES IN THE FLEMISH FRUIT AND VEGETABLE SECTOR

EXECUTIVE SUMMARY

Cosmetic quality standards for fruits and vegetables are specific requirements with regard to colour, shape and size which harvested products have to meet after preparation and packaging. Their aim is to promote trade, optimise the packaging and logistic process and enable product differentiation.

In the literature, cosmetic quality standards are often linked to food losses. Compliance often means that part of the food production will not be used in the human food chain, but will be rather intended for low value valorisation.

Currently, knowledge on cosmetic quality standards and the quantitative consequences on food marketing are relatively limited. A number of reports show that a considerable part of fruits and vegetables is discarded, but only few data are available. Preventing food waste is on the policy agenda of Flanders, so additional research is needed to identify the challenges in Flanders and to work out solutions. To that aim, a survey was conducted among 300 horticulturists.

The survey revealed that more than 2/3 of all farmers are not able to sell part of their products in the intended sales channel, since the required cosmetic quality standards were not met. The unpredictable climate circumstances are believed to be the major cause of cosmetic defects.

On average, a sales loss of about 10% is indicated, although the differences among sectors and farmers can be considerable. In at least 1/3 of all cases, the sales losses are valorised for human consumption through processing, social initiatives and direct selling at the farm.

More than half of all misshapen fruits and vegetables, accounting for just under 120.000 tonnes of the major crops, disappears from the human food chain, which causes food losses. They are used for animal feed, for anaerobic digestion, for composting, for application to land or are simply not harvested.



Flanders

is agriculture and fisheries

Several players have the potential to reduce food losses caused by cosmetic quality requirements. Retail has already run several campaigns to bring ‘ugly’ fruits and vegetables onto the market. To avoid the creation of a demand for defect products, these kinds of actions are only on a small scale and are limited in time. The processing industry and innovative startups take initiatives as well for high value valorisation of these products.

Several action perspectives came up during the workshop with stakeholders from the food chain. A proposal was to lower the quality standards, thereby making a distinction between the visual and intrinsic quality of fruits and vegetables. Furthermore, the suggestion was made to process the rejected fresh products into products with a longer expiration date, so that food surpluses can be used to tackle food poverty. The auctions are proposed to fulfill a coordinating role to collect all flows coming from farmers and to distribute them for human and other purposes.

Finally, policy as well has its own role to play, within the European framework, as to minimize food losses in case of valorisation of sales losses. For each crop it should therefore be examined whether and how this objective can be achieved.

CONTENT

Executive summary	1
1 To what extent do cosmetic quality standards cause food losses?.....	3
2 Methodological approach.....	3
3 International context.....	4
4 Case study: Flemish fruit and vegetable sector.....	6
4.1 Relevant public and private standards	6
4.2 Food losses in horticulture and auctions	6
4.3 Quantification of food losses due to cosmetic quality requirements.....	7
5 Action perspectives.....	12
More information.....	12
List of sources.....	13

1 TO WHAT EXTENT DO COSMETIC QUALITY STANDARDS CAUSE FOOD LOSSES?

A (product) norm or standard is a document containing approved commitments, specifications or criteria on a given product, laid down by a consortium of organisations or by recognised standardisation bodies. These norms or standards include inter alia compulsory quality requirements. These are specific requirements or permitted tolerances which have to be met after preparation and packaging. They may deal with hygiene or food security, but also with cosmetic aspects of products. The latter one is the focus of this report: cosmetic quality standards for fresh fruits and vegetables.

These requirements often deal with the colour, shape and size of products. Cosmetic quality requirements are often based on good arguments. They may be intended to promote trade (see for example trade norms), to optimise the logistic and packaging process (size tailored to packaging or transport) or to allow differentiation (diversity on the shelf).

Fruits and vegetables may fail to meet the cosmetic quality standards in many ways. Literature links cosmetic quality requirements to food losses. In the literature, it is stated that (high) cosmetic requirements are responsible for part of the production being pushed towards other applications, this way being subject to lower value valorisation. However, 'downgrading', giving a product a lower grade down to a lower quality class, does not have to imply food losses. Fruits and vegetables of a lower cosmetic quality are often processed into other food products. Nonetheless, quality standards of a cosmetic kind may cause part of the production disappear from the human food chain ('outgrading'). In other words, food losses may occur.

Prevention of food losses is high up on the Flemish political agenda. The Government of Flanders and its food supply chain partners are currently carrying out the Food supply chain Roadmap on Food loss together, trying to reduce food losses by 15% in Flanders by 2020 (Government of Flanders et al., 2015).

Today, knowledge on concrete cosmetic quality standards and the quantitative consequences on the sales of products are rather limited. Most reports state that a considerable part of the fruit and vegetable production for human consumption goes to waste. This is often said to be a structural problem. However, any numerical justification of this issue is lacking. If any data are available, it often involves no primary or generalisable research data. Usually it concerns estimations or references to other reports, or in other cases interviews, testimonies and quotes are used.

To clarify this issue, the Department of Agriculture and Fisheries has taken the initiative, together with the fresh supply chain, to draw up an analysis of the impact of cosmetic quality standards on food losses and valorisation. The focus of this report is on the Flemish fruit and vegetable sector.

2 METHODOLOGICAL APPROACH

In the first place, an analysis was made of the existing cosmetic quality standards and their impact, at both European and at global level. This was done on the basis of a literature study.

By means of interviews with a number of important stakeholders, the Flemish context was identified. The results were used to conduct a survey with Flemish horticulturists in order to obtain a better view on the scale of the problem and how producers deal with it.

The survey was spread in June 2016 via two auctions (Reo-veiling and Veiling Hoogstraeten) and the horticulturists who are member of the Landbouwmonitoringsnetwerk (LMN), managed by the Department of Agriculture and Fisheries.

After having analysed the results, a workshop was organised in October 2016 to which several actors in the sector (farmers, auctions, processors, retail, policy makers and civil society) were brought together to reflect upon possible ways to reduce these flows, and to assess how products that do not meet the cosmetic quality requirements can be valorised as high as possible.

3 INTERNATIONAL CONTEXT

It is very important for the fruit and vegetable sector that all countries apply the same trade standards. Two international organisations, the UNECE (United Nations Economic Commission for Europe) and the Codex Alimentarius are responsible for this.

UNECE is the UN organisation that establishes trade standards for agricultural products, such as fresh fruits and vegetables. The UNECE has set standards for 54 products (UNECE, 2016a). These standards facilitate higher production and quality, protect consumer interests and improve production profitability. These standards are used by authorities, as well as by producers, traders, importers, exporters and international organisations. If products meet the UNECE standards, these products also comply with the European Commission's general trade standard.

The European Union establishes the legal quality standards that apply in Europe (OECD, 2016). Until 2008, there were standards for 36 kinds of fruits and vegetables. On 1 July 2009, the European Commission reduced the number of standards down to 10 (Canali, 2014). From that date on, a general trade standard applies for all fresh, unprocessed fruits and vegetables. This general trade standard applies for 26 products since, without any specific rules on size, shape and colour.

Products do not have to comply with the trade standards if:

- The producer sells them directly to the consumer for personal use
- The products are destined for 'industrial processing', for 'animal feed' or for a use other than food
- The products are prepared and cut in a way they are 'ready to use' or 'ready to cook'.

For ten products, inter alia apples, tomatoes, lettuce, citrus fruit and kiwifruit, the specific rules were maintained. And exactly these products represent 75% of the cash value of the fruit and vegetable sales. These specific trade standards contain minimum quality requirements, classification, grading, uniformity, tolerances and indications.

The EU classifies each of these products into 3 well-defined classes: Extra, Class I and II. These classes are subdivided into uniform characteristics regarding shape, skin, colour and size. For each of these classes, different deviations are allowed compared to the standards. These classes are used by the producer organisations in Belgium as well.

Simplifying the European rules in 2009 didn't bring many changes. The simplification only pertained to 25% of the market and the sector continued applying the old, abolished prescriptions as private standards (FAO, 2011; Loebnitz et al., 2015). An argument in favour is that regularly shaped and sized products are easier to stock and distribute, whereas products with an irregular shape and size create

inefficiencies in the logistic process (Waarts et al., 2011). What is more, retailers argue that their consumers demand 'cosmetically perfect' fruits and vegetables. A study carried out by the European Commission (2015) pointed out that price reductions will lead to greater willingness to purchase imperfect food. However, if there is no price reduction in return, 74% indicates they would prefer the cosmetically 'perfect' product. Apparently, consumers' low degree of acceptance for cosmetically imperfect fruits and vegetables, makes retailers maintain the quality standards (Stuart, 2009). But more than that, supermarkets apply their own standards which are stricter than the legal ones were ever before. Products for which the European Commission allowed defects with regard to shape, development and colour – one might call them the ugly fruits and vegetables – are kept out of the stores.

Imposed cosmetic quality standards may lead to food losses, both in developed and developing countries. What doesn't look nice enough, will be rejected and can be used for lower value non-human purposes.

Worldwide, one third of all food is wasted (FAO, 2011). Within the fruit and vegetable sector, approximately 20% of the production is lost at farm level. This figure represents the highest loss throughout the chain. According to the FAO, a major part of this loss is due to certain practices in the retail: cosmetic quality standards as well as orders cancelled last-minute.

The UNECE and FAO organised the conference 'No time to lose on food loss' in November 2016. On this conference, quality standards and their potential role in causing, but as well preventing food losses worldwide were discussed (UNECE, 2016b).

Within the EU, few studies and figures are available about food loss caused by cosmetic quality standards.

- Wrap (2011) investigated the fruit and vegetable chain in the UK. The study reports that 2.23 up to 2.48 million tonnes of food go to waste due to several reasons. Cosmetic quality standards are mentioned as one of the reasons. Improvements within the chain to reduce food losses and economic losses could save about 400 to 500 millions of British pounds.
- A study carried out by the Swedish Board of agriculture (2014) states that the impact of the legal standards is limited, since the market often sets stricter requirements than the limit established by the lowest legal class. Standards only increase food losses if they prevent products matching the market demand to be sold. However, standards may have an indirect impact by their influence on product prices. Financial considerations may lead to products of a lower class not to be harvested, even if they were eligible for it. Theoretically, the major sales limit is the minimum limit of class 2. Yet, the larger players will only buy class II to a very limited extent in practice, which de facto means that the minimum limit in reality is that of class I. Class II products are only bought at very low prices that are hardly profitable for the producers trying to sell their product. However, this is only the case if a sufficiently large amount of products are placed on the market, so that buyers have a choice.
- Likewise, a study lead by Wageningen UR (Waarts *et al.*, 2011), points at certain legal European trade standards, despite their being abolished, still being applied in practice. These norms are now applied as private quality requirements. This is partly related to the fact that the chains are not adapted yet to the new possibilities. Thus, these are private barriers and not legal ones, which indicates that adapting legislation apparently does not suffice. Businesses should look together for possibilities to process fresh fruits and vegetables with abnormal shapes, sizes or colours.

4 CASE STUDY: FLEMISH FRUIT AND VEGETABLE SECTOR

4.1 RELEVANT PUBLIC AND PRIVATE STANDARDS

Evidently, the European trade standards apply in Flanders. Furthermore, a number of (international) private quality standards are of importance, as well as some cooperation-specific quality standards.

The main private quality standard that is used in the Flemish retail sector is the British BRC Global Standard for Food Safety. A large number of Belgian retailers have taken over this standard in the mean time. Comparable standards are the International Food Standard, usually abbreviated as IFS, and Qualität und Sicherheit (QS). However, all these quality standards do not focus on cosmetic quality requirements.

Moreover, these private standards are supplemented with cooperation-specific quality labels, of which Flandria is the best-known. These standards as well contain specific requirements defining the characteristics a product should meet in order to qualify for these 'superior' standards. Exactly these labels and standards allow producers to differentiate from competitors. Retailers have their own procurement policy in order to implement their strategy on differentiation.

Auctions mainly apply the classes mentioned above, as established by EU-legislation. However, the 'Extra' class is used very rarely, since the legislation only allows a very small percentage of the supplied quantities to show defects. According to the auctions, this is a mission impossible, and therefore they mainly use classes I and II. Yet, it is stated that classes I and II are further subdivided, depending on the quality. In particular, lower class I, higher class I is used, and in addition there is a category of for example Flandria labeled fruits and vegetables belonging to the highest class I. Class II is not subdivided further on. This means that all 'ugly' fruits and vegetables are included in this class.

With regard to import and export, the European rules apply. When opening up to international trade, the UNECE rules are to be followed. As said earlier on, these are very closely related to the European legislation. In normal circumstances, both import and export run smoothly.

4.2 FOOD LOSSES IN HORTICULTURE AND AUCTIONS

When food resources or products disappear from the human food chain, because they are intended for a non-human purpose, food waste occurs.

In the **Flemish horticulture**, food waste accounts for approximately 283.000 tonnes, divided between vegetables in open air, vegetables in sheltered cultivation and fruits. As for food waste, the main horticultural crops are leek (for the fresh market, 30% of food waste in horticulture), onions (for the industry, 12% of food waste in horticulture) and spinach (for industry, 7% of food waste in horticulture). Other important crops with respect to food waste are pears, cauliflowers (for industry), carrots (for industry), leek (for industry) and apples. This food waste is primarily destined for being ploughed in the soil, representing 62%. In second place food waste is used in animal feed (18%).

Making a distinction between edible and non-edible fractions in food waste gives us an idea of the food losses resp. residues. The 449.000 tonnes of food waste in agriculture consists for 74% of food losses (or 330.000 tonnes) and for 26% of residues (or 119.000 tonnes). In horticulture, food waste can be subdivided into 79% of food losses (223.000 tonnes) and 21% of residues (60.000 tonnes).

As for the quantity of food losses, the main horticultural crops are leek (for fresh market – 29% of food losses in horticulture), onions (for industry – 11% of food losses in horticulture) and carrots (for industry – 7% of food losses in horticulture). Other relevant crops are cauliflower (industry), leek (industry), chicory (fresh), lettuce (fresh), pears (fresh) and apples (fresh), which all account for approximately 5% of the overall food losses in horticulture.

The **Flemish producer organisations in the fresh market (vegetable and fruit auctions)** have their surpluses withdrawn from the market through intervention programs. Unsold products are primarily donated to social organisations. What is not collected for free donation is used for non-human valorisations. In 2015, 14,337 tonnes of marketable products were withdrawn from the market. In total, 1,477 tonnes of fruits and vegetables or 10% of total withdrawn products were donated.

Food waste in the producer organisations operating in the fresh market amounts to 14,277 tonnes. This food waste consists for 84% of marketable products that were withdrawn from the market and were not intended for free donation. The remaining 16% consists of non-marketable products (organic waste). Marketable products consist for 62% of vegetables and for 38% of fruits. Apples (55%) and pears (41%) are the main fruit products, completed by strawberries (4%). The main vegetable products are tomatoes (37%), lettuce (28%) and 'other vegetables' (14%). This list is completed by paprika (9%), chicory (8%) and zucchini (5%). Food waste in producer organisations is mainly destined for animal feed (36%), soil (28%) and composting (17%). The food waste consists almost exclusively of food losses (96% or 14,629 tonnes). Compared to the overall supply of products in producer organization, food losses account for 1.4%.

The above figures cover all the food waste and food losses in horticulture and the auctions, and not the flows specifically related to cosmetic quality requirements. The report "Food waste and food losses: prevention and valorization. Monitoring Flanders 2015" contains more information on food waste and food losses in the Flemish agri-food chain (Flemish Food Supply Chain Platform for Food Loss, 2017).

4.3 QUANTIFICATION OF FOOD LOSSES DUE TO COSMETIC QUALITY REQUIREMENTS

In total, 299 farmers and horticulturists filled out the online survey, at least partly. In this report, incomplete replies to the questionnaire are taken into account as well. 62% of the respondents grows vegetables, 26% grows fruits and 10% grows both vegetables and fruits. Among vegetable farmers, a wide variety of crops can be perceived. Among respondents, leek is the most frequently grown crop, followed by lettuce and cauliflower. The majority of the fruit farmers are strawberry farmers, yet a number of farmers growing apples, pears, cherries, grapes, berries and raspberries are represented as well.

Auctions are the primary sales channel, however, a significant portion of the farmers does not confine itself to only one sales channel. Sale to the auction is often combined with sale to the industry or direct sale to consumers.

Opinion on cosmetic quality requirements

When assessing the opinions on quality requirements, two clearly separate groups can be identified which are almost identical in size, both uttering extreme as well as moderate views. On the one hand, there are opponents (49%) for whom the quality requirements are (too) stringent, exaggerated or even absurd. On the other hand, there are advocates (50%) for whom quality requirements are fair, good and feasible. Part of the advocates nuance their positive opinion. They agree with the requirements, yet the price that is paid in return for these efforts is insufficient in their opinion.

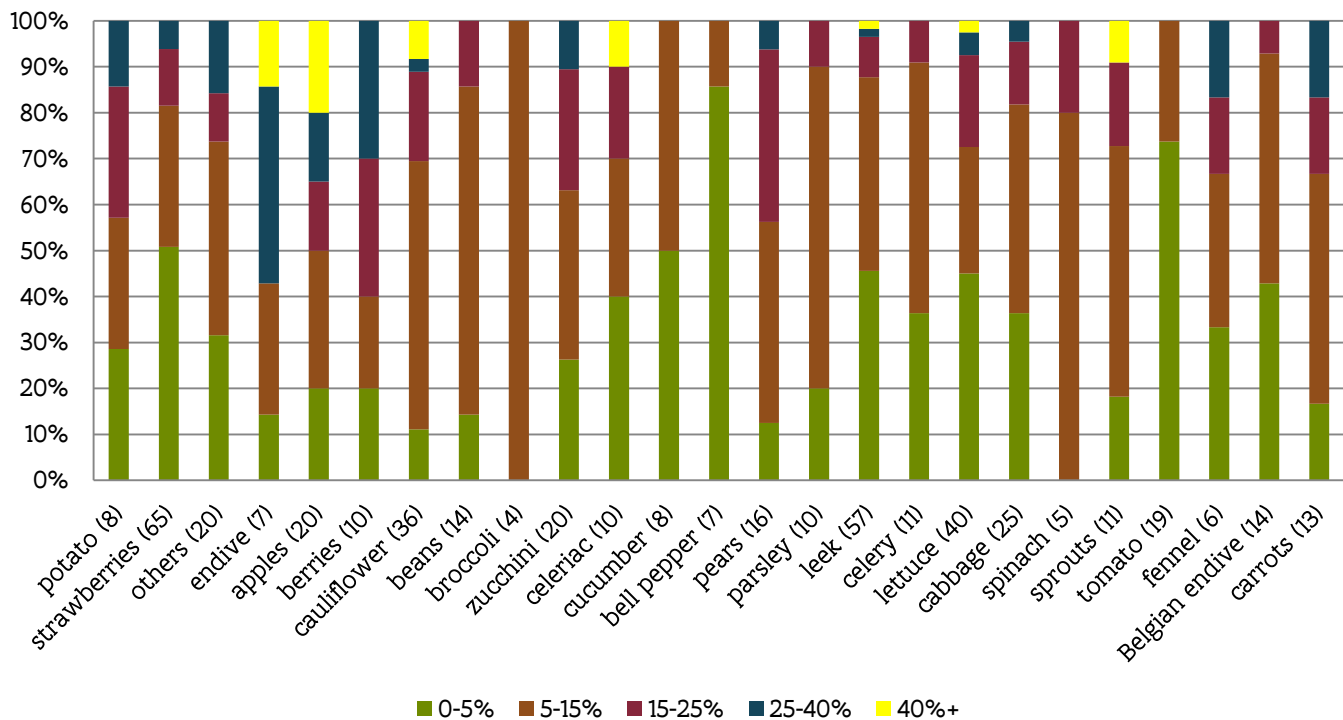
In line with these results, 43% of all respondents would like to see the visual cosmetic requirements be relaxed. The other 57% feels no need to relax the quality requirements, they indicate the requirements to be feasible. Particularly the respondents for whom the requirements are too severe, are in favour of a relaxation.

Sales losses due to cosmetic quality requirements

66% of the respondents answers that some of the products cannot be sold, because they don't satisfy the required appearance. This means there is a 'sales loss'.

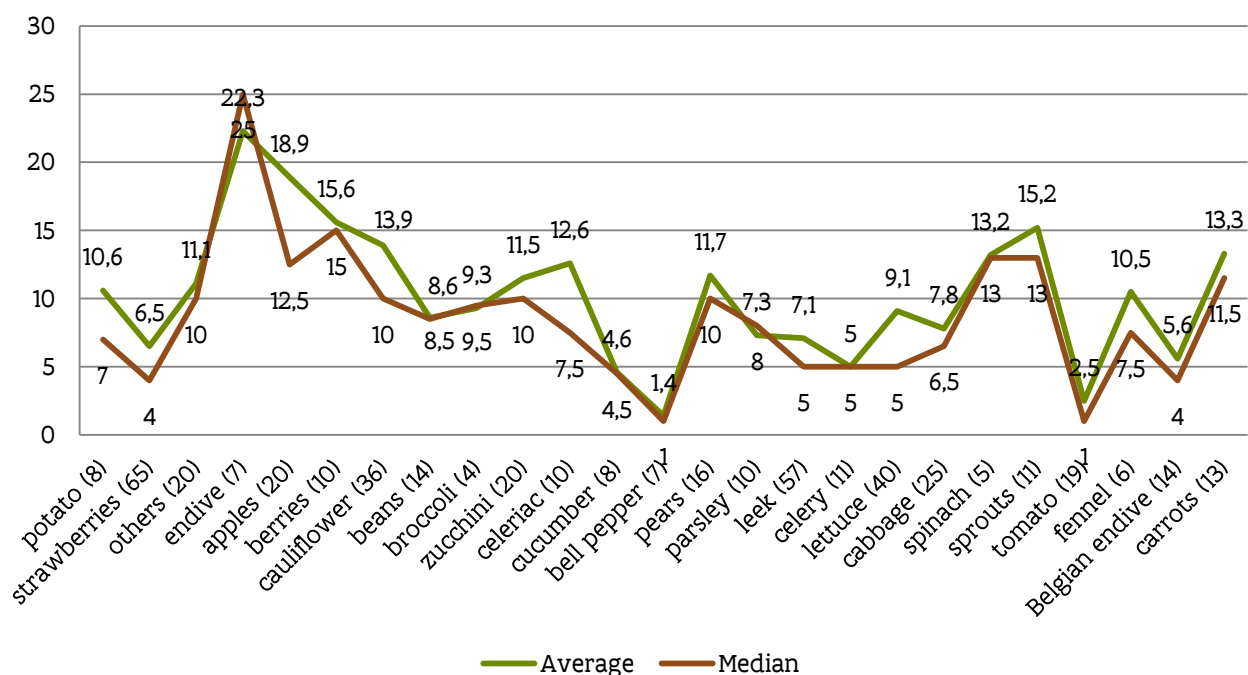
Figures 1 and 2 provide an overview of the rates of sales losses per crop incurred by farmers. The number of farmers for each crop in the survey is mentioned between brackets. The more frequent crops are being grown, the more representative the drop-out rate in the figure will be. Figure 1 includes categories depending on the level of sales loss. The figure reads as follows: 20 of the respondents are apple farmers, 20% of them claims to have less than 5% of sales losses, 30% reports a sales loss between 5 and 15%, approximately 15% has a loss between 15 and 25%, another 15% reports a sales loss between 25 and 40%, and finally 20% say they have a sales loss of over 40%. Figure 2 displays the average and median sales losses.

Figure 1: Sales loss rate per crop



Source: own data collection

Figure 2: Sales loss rate per crop: average and median



Source: own data collection

When analysing the crops grown by at least 10 of the respondents, the problem of considerable sales loss rates apparently lies with vegetables, mainly cauliflower (on average 13.9%), zucchini (11.5%), celeriac (12.6%) and carrots (13.3%). An average drop-out for these crops of over 10% and loss rates of over 25% are not unusual.

For leek (7.1%), celery (5.0%), Belgian endive (5.6%), cabbage (7.8%), beans (8.6%), parsley (7.3%) and tomatoes (2.5%) the drop-out is considerably lower and remains on average under 10%. Except for cabbage, where a sales loss exceeding 25% was reported. For the majority of the respondents, the sales loss remained under 15%.

As for fruit, the problem appears to be the greatest for apples. There is a drop-out of nearly 20% and for more than 1/5 of the respondents the loss exceeds 40%. For pears the drop-out is more limited (on average 11.7%) and no loss rates of over 40% were registered. For strawberries the major part of the drop-out is limited to a maximum of 25%, the average loss amounts to only 6.5%.

The main reason (81%) of drop-out for cosmetic reasons are the climatological production circumstances. Subsequently, pests and diseases (37%), seeds and varieties (10%) and defects due to harvesting processes (10%) play a role. The respondents were able to indicate several causes. The rates indicate for which fraction of the respondents a given answer was quoted as a cause.

Use of rejected products

The largest rate of products that don't satisfy the quality requirements (58%) is sold in a lower category, and thus at a lower price at the auction. The respondents pointing out their crops are not harvested (35%) or are applied back to land (25%), represent a second important group. Other less frequent options are selling to industrial processors (14%), direct selling at the farm (11.7%), use as animal feed (11%) or for composting (11%).

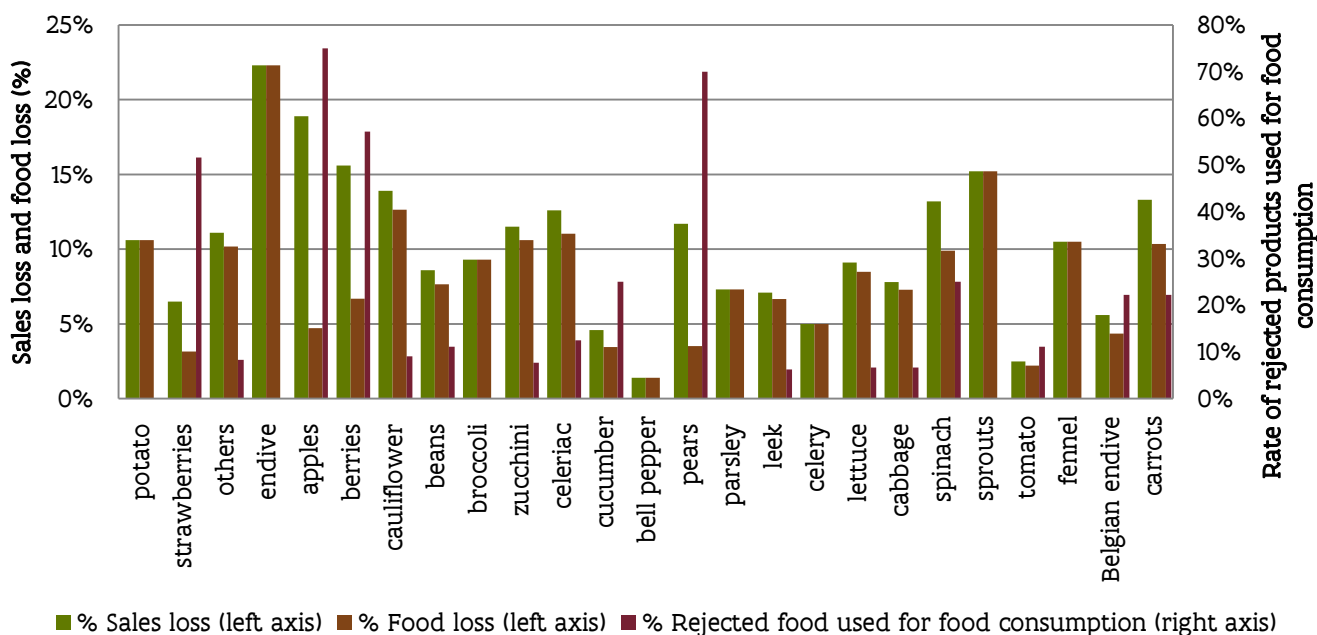
When sales loss becomes food loss

We speak of food losses if food products are eventually not used for human consumption. However, if part of the sales losses is used for human consumption via a lower class at the auction, processing, direct selling or via donations to social organisations, we don't speak of food loss. If products are applied back to land, used as animal feed, composted, anaerobic digested or simply not harvested, they become a food loss. Thus, it is important to make a distinction between sales losses and food losses. On the basis of the results of the survey, an average sales loss of 10% throughout all crops can be observed. When it comes to the use of these rejected products, 34% of the sales loss is intended for human purposes, whereas 54% is intended for non-human purposes. The remaining part of the rejected products, farmers indicate both human and non-human valorisations. These combined purposes were not included in the further calculations. Only farmers who used their rejected vegetables for exclusive human or exclusive non-human valorisation, were kept and were equated with 100%.

More interesting than an overall view, is an assessment of the food losses for each crop. This is displayed in figure 3. The left axis shows the sales and food loss, the right axis shows the rate of rejected products being used for human food. The rate serves as basis to calculate how much of the sales loss has effectively resulted into food loss. The larger the brown bar, the smaller the food loss and the bigger the difference between the red and the green bar.

With regard to the fruit products that are grown by the respondent farmers, more than 50% of the sales loss is valorised for human food. For apples and pears, this even amounts to over 70% of the rejected fruits. This is in great contrast with the destination of the rejected vegetables. A maximum of 25% of the sales loss thereof will end up in the food chain and differences between types of vegetables are substantial. Rejected cucumber, spinach, Belgian endive, carrots, celeriac, tomatoes and beans are intended for human food in 25% of all cases. With respect to cauliflower, zucchini, leek, lettuce and cabbage, valorisation after rejection is limited to 10%. The remaining vegetables in the survey, when they don't meet the cosmetic quality standards, are only used for non-human purposes. Consequently, the sales loss for these vegetables equates with the food loss.

Figure 3 Sales loss versus food loss

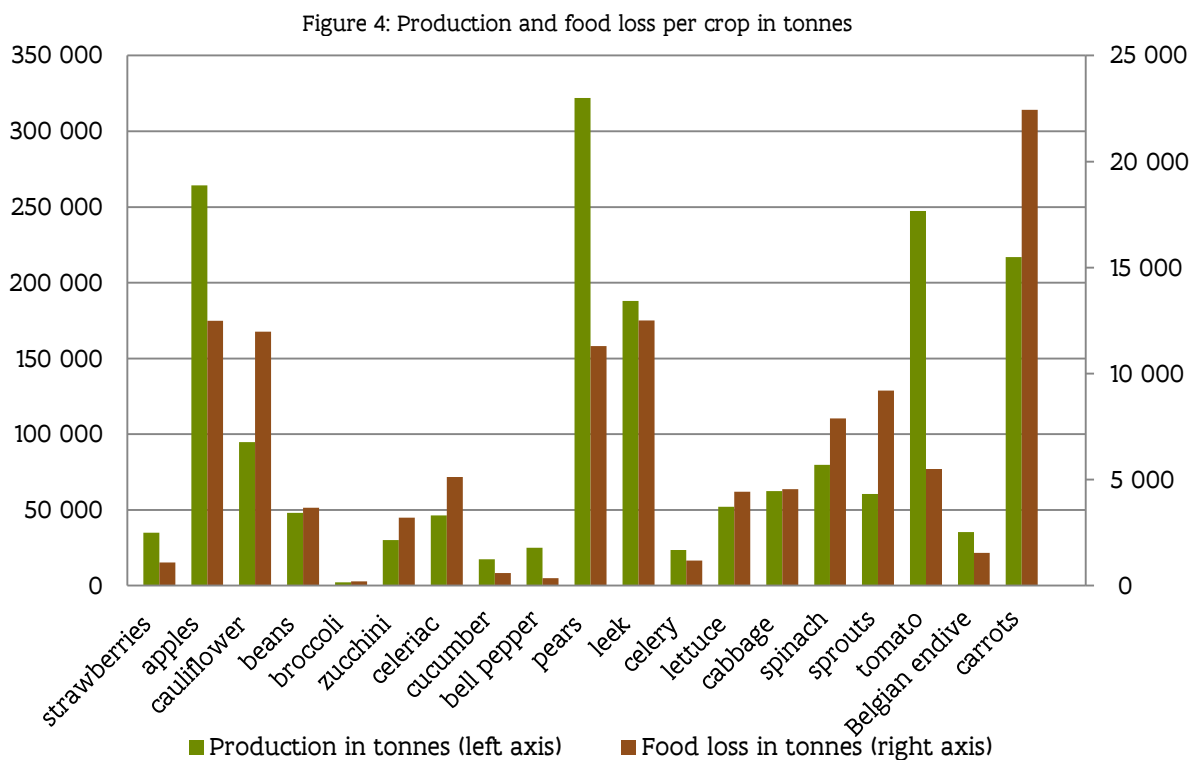


Source: own data collection

The rates in the above figure provide a first important view on food losses per crop. However, to know the impact of these losses at production level, we should include the production data for each crop as well.

The figure below provides this overview, however only for the major crops of which the production data from 2014 are available. The left axis displays the overall production in tonnes, the right axis shows the food loss in tonnes, i.e. the fraction of the production that does not meet the cosmetic quality standards and subsequently is not used for human valorisation. Importantly, when interpreting the chart, one should be aware that the scaling of the axes is different. For example, in the case of carrots the right bar (food loss in tonnes) shows slightly higher compared to the left one (production in tonnes). This makes it look as if the tonnage of food loss exceeds the tonnage of production, which of course is impossible. This is due to a different scaling of the axes to make the figure easier to read.

At production level, the largest food losses are on account of carrots: over 20,000 tonnes. As regards leek, apples, cauliflower and pears, somewhat more than 10,000 tonnes of rejected products are lost for human consumption. As for the remaining vegetables, the food loss amounts to less than 10,000 tonnes per year. The overall losses for all crops together amount to just under 120,000 tonnes. Nevertheless, this is an underestimate of the food losses. With regard to the sales loss which is used for both human and non-human purposes, the volume of either fractions is unknown. Therefore this was left out.



Source: own data collection

5 ACTION PERSPECTIVES

In order to highlight food losses due to cosmetic quality requirements, several studies and campaigns have been carried out as to bring 'ugly' fruits and vegetables onto the market. Consumers are willing to buy such products, if there is some price reduction in return. Inter alia Intermarché and Delhaize have committed to sell fruits and vegetables showing flaws in appearance.

Important for these actions is their temporary character, for the volume of rejected products is too limited to provide a permanent offer. Retailers clearly indicate this, as to avoid the creation of a demand for farmers to produce more 'ugly' fruits and vegetables, since this would lead to a decreased quality and higher packaging costs. Apart from the retail, innovative startups take initiatives as well to reduce and valorise food losses. The survey shows that farmers consider the processing industry as the major player to submit rejected products to high value valorisation.

In order to obtain a better view on how the different stakeholders in the food chain look at food losses, a workshop was organised where players from agriculture, civil society, auctions, processors, retail and policy makers were brought together to discuss. This resulted into several action perspectives.

Firstly, standards were suggested to be relaxed, in particular with respect to the interpretation of the notion 'quality'. The focus mainly lies on visual quality, whereas this doesn't have any influence on the intrinsic quality of the product. That is why segmentation of the type of quality may help to reduce food losses, and awareness on this subject matter among consumers should be raised.

Furthermore, higher value human valorisation is deemed necessary as well. The processing industry may help reduce food losses by processing fresh fruits and vegetables into products with longer expiration dates. Through cooperation with authorities they may be led towards people living in poverty. Economic sustainability of non-human valorisation towards animal feed or industrial resources is perceived as difficult.

There are as well opportunities at the level of auctions, policy and research. A better management of food losses might be possible if auctions were to collect and distribute all flows of farmers, both directly towards fresh food, as is already the case now, and towards other human and non-human valorisations. In addition, policy makers may take initiatives to ensure maximum prevention of food losses due to vegetables or fruits left unpicked. A policy with regard to food surpluses and losses should always be considered within a European context. With a view to valorisation at the highest possible level, the options for each product should be explored.

MORE INFORMATION

The research was ordered by the Department of Agriculture and Fisheries of the Government of Flanders as a contribution to the Food supply chain Roadmap on Food loss (Government of Flanders et al., 2015). The research was carried out by the University of Ghent.

Contact details:

Kris Roels, Policy Advisor
Government of Flanders - Department of Agriculture and Fisheries
+32 2 552 78 24 - kris.roels@lv.vlaanderen.be

Citation:

Roels K. & Van Gijsegem D. (2017) *The impact of cosmetic quality standards on food losses in the Flemish fruit and vegetable sector*, summary report, Department of Agriculture and Fisheries, Brussels. D/2017/3241/301

This document is an English summary of the full report (in Dutch):

Gellynck X., De Pelsmaeker S., Lambrecht E. & Vandenhautte H. (2017) *De impact van cosmetische kwaliteitseisen op Voedselverlies. Casestudie Vlaamse sector groenten en fruit*, ordered by the Department of Agriculture and Fisheries, Brussels.

Download the summary report and full report (in Dutch) at

WWW.VLAANDEREN.BE/LANDBOUW/STUDIES

LIST OF SOURCES

Canali M. (2014) *Drivers of current food waste generation, threats of future increase and opportunities for reduction*, EU-Fusions project, Bologna.

European Commission (2015) *Milan BExpo 2015: A behavioural study on food choices and eating habits*, final report, European Commission, Directorate-General for Justice and Consumers, Brussels.

FAO (2011) *Global food losses and food waste – Extent, causes and prevention*, Food and Agriculture Organization of the United Nations, Rome.

Gellynck X., De Pelsmaeker S., Lambrecht E. & Vandenhautte H. (2017) *De impact van cosmetische kwaliteitseisen op voedselverlies: casestudie Vlaamse sector groenten en fruit*, in opdracht van Departement Landbouw en Visserij, Brussel.

Government of Flanders, Boerenbond, FEVIA Vlaanderen, COMEOS Vlaanderen, Horeca Vlaanderen, Unie Belgische Catering, Unizo, Buurtsuper.be, Onderzoeks- en informatiecentrum van de verbruikersorganisaties (2015) *Food supply chain roadmap on Food loss: 2015-2020*, Brussels.

Loebnitz N., Schuitema G., & Grunert K. G. (2015) *Who Buys Oddly Shaped Food and Why? Impacts of Food Shape Abnormality and Organic Labeling on Purchase Intentions*, *Psychology & Marketing*, 32 (4).

OECD (2016) *Scheme for the application of international standards for fruit and vegetables*, Organisation for Economic Co-operation and Development (OECD), <http://www.oecd.org/tad/code/oecdfruitandvegetablesstandardsbrochures.htm>

Stuart, T. (2009) *Waste – uncovering the global food scandal*. Penguin Books, London, ISBN: 978-0-141-03634-2.

Swedish Board of Agriculture (2014) *Why do we throw away edible fruit and vegetables?*, report 2014:5 EN, Swedish Board of Agriculture, Jönköping.

UNECE (2016a) *Agricultural Quality Standards - Fresh fruit and vegetables*, United Nations Economic Commission for Europe – UNECE, https://www.unece.org/fileadmin/DAM/trade/agr/standard/fresh/fresh_e.htm

UNECE (2016b) *Seventy-second session of the Working Party on Agricultural Quality Standards (WP.7)*, United Nations Economic Commission for Europe – UNECE, <http://www.unece.org/wp7-2016.html#/>

Flemish Food Supply Chain Platform for Food Loss (2017) *Food waste and food losses: prevention and valorization. Monitoring Flanders 2015*, Government of Flanders, Brussels.

Waarts Y., Eppink M.M., Oosterkamp E.B., Hiller S., van der Sluis A.A. & Timmermans A.J.M. (2011) *Reducing food waste: Obstacles experienced in legislation and regulations*, LEI report 2011-059, Wageningen UR, The Hague.

WRAP (2011) *Fruit and vegetable resource maps*, final report, Waste & Resources Action Programme, Banbury.